



Range expansion and noteworthy records of Costa Rican birds (Aves)

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Abstract

We present new distribution information for 19 species of Costa Rican birds. Thirteen species show changes in altitudinal distribution, 9 are recorded at higher elevations such as *Egretta rufescens* (Gmelin, 1789), *Heliomaster constantii* (Delattre, 1843), *Myiozetetes cayanensis* (Linnaeus, 1766), and *Lonchura malacca* (Linnaeus, 1766), and 4 are recorded at lower elevations, *Panterpe insignis* Cabanis & Heine, 1860, *Empidonax albigularis* Sclater & Salvin, 1859, *Sayornis nigricans* (Swainson, 1827), and *Dacnis venusta* (Lawrence, 1862). We recorded 2 forest understory species, *Geotrygon montana* (Linnaeus, 1758), and *Grallaria guatimalensis* Prévost & Des Murs, 1842, inside the area of the county with the most urban development. Finally, *Saltator grossus* (Linnaeus, 1766), which was restricted to Caribbean forest, was recorded at the South Pacific rainforest for the first time.

Key words

Antpitta; Caribbean region; Central Valley; heron; highlands; parrot; Pacific rainforest region.

Academic editor: Michael J. Andersen | Received: 20 April 2017 | Accepted 6 December 2017 | Published 19 January 2018

Citation: Sandoval L, Martínez D, Ocampo D, Pizarro MV, Araya-H D, Carman E, Sáenz M, García-Rodríguez A (2017) Range expansions and noteworthy records of Costa Rican birds (Aves). Check List 14 (1): 141–151. <https://doi.org/10.15560/14.1.141>

Introduction

The avifauna of Costa Rica is comprised of 920 species, including extinct, accidental, regular migrants, and residents (Sandoval and Sánchez 2016). Since the publication of Stiles and Skutch (1989), the first field guide to the birds of Costa Rica and the first comprehensive compilation of bird species distribution in the country, the distribution of several bird species has changed (e.g. Sánchez et al. 1998, Sandoval et al. 2010, Biamonte et al. 2011). For example, notable records have been added of Caribbean species recorded on the Pacific slope (Alvarado-Quesada and Biamonte 2003, Sandoval and

Fernández-Ramírez 2012), Pacific rainforest species in the Central Valley and on the Caribbean slope (Sandoval and Ellis 2006, Barrantes and Biamonte 2004, Martínez et al. 2009), and dry-forest species recorded in Caribbean or Pacific rainforests (Sandoval and Vargas 2007, Sandoval 2013). These changes in distribution are thought to be associated with landscape modifications and increasing of temperatures (Biamonte et al. 2011, Sandoval 2013) for some bird species, but due to other, unexplained reasons for others (Sandoval et al. 2010). Changes in distribution and range expansion appear to be an unstoppable phenomenon due to the constant changes in land use, temperature, and climate change

(Crick 2004, Prieto-Torres et al. 2016). Herein, we provide new distribution information for 19 species of Costa Rican birds.

Methods

Our records are based on specimens or opportunistic observations, with supporting documentation, made between 1997 and 2016 from 15 localities in Costa Rica. Specimens were collected under permit (permit numbers 181-201-SINAC, SINAC-SF-611-SP-R-072-2014, and SINAC-SE-GASP-PI-R-059-2015) from the Ministerio del Ambiente y Energía de Costa Rica and the Sistema Nacional de Áreas de Conservación. All collected individuals were deposited in the Museo de Zología, Universidad de Costa Rica (MZUCR). Identifications were based on photographs and comparative specimen material at MZUCR or on published information and illustrations (Stiles and Skutch 1989, Garrigues and Dean 2014).

Results

***Cairina moschata* (Linnaeus, 1758), Muscovy Duck.** This species regularly breeds on both coasts below 500 m in Costa Rica, mainly in freshwater wetlands with and without open water (Stiles and Skutch 1989, Garrigues and Dean 2014). In the rest of the country, it is common to observe feral individuals in artificial lagoons, mainly in parks at elevations up to 2000 m. Feral and wild individuals can be separated based on behavior, plumage differences, and body size. Feral individuals have unusual plumage (e.g. white body patches, crests, or curly tails) and are smaller. Wild individuals do not approach humans and are larger (pers. obs.). We observed 4 juveniles following two adult birds in Angostura Reservoir, Cartago province ($09^{\circ}52'00''$ N, $083^{\circ}39'00''$ W; 569 m elev.), on 20 November 2014 (Fig. 1A). We observed a single individual foraging near a group of 50 *Aythya affinis* (Eyton, 1838), Lesser Scaup, in Cachí Reservoir, Cartago province ($09^{\circ}49'38''$ N, $083^{\circ}49'00''$ W; 1000 m elev.), on 21 November 2015. These individuals lacked plumage characteristics that would suggest a feral origin (e.g. white plumage and a crest) and moved away when approached. Therefore, we are confident that these particular individuals were wild. These 2 observations represent the first breeding evidence and the highest elevational record in Costa Rica for non-feral individuals, respectively.

***Egretta rufescens* (Gmelin, 1789), Reddish Egret.** This species occurs mainly in brackish waters along both coasts of Costa Rica from November to April (Stiles and Skutch 1989, Garrigues and Dean 2014). We observed an adult foraging in an ephemeral lagoon inside a cattle pasture at San Isidro de Coronado, San Jose province ($09^{\circ}58'59''$ N, $084^{\circ}00'19''$ W; 1389 m elev.), from 23 December 2010–3 March 2011 (Fig. 1B). The dark morph of this egret may be confused with *Egretta caerulea* (Linnaeus,

1758), Little Blue Heron, due to a similar plumage color, but the bicolored beak with pinkish base and black tip is diagnostic of *E. rufescens*. This is the first inland and the highest elevational record documented for *E. rufescens* in Costa Rica.

***Nyctanassa violacea* (Linnaeus, 1758), Yellow-crowned Night-heron.** This species occurs along lowlands below 500 m on both coasts of Costa Rica (Stiles and Skutch 1989, Garrigues and Dean 2014). On 18 October 2013 we observed 1 juvenile perched on the edge of an artificial pond at Hacienda Las Cónicas, Cartago province ($09^{\circ}51'00''$ N, $083^{\circ}53'00''$ W; 1350 m elev.). Juveniles may be confused with *Nycticorax nycticorax* Linnaeus, 1758, Black-crowned Night-heron, due to similarities in their plumage, but the entirely black beak occurs only in juvenile *E. violacea* (Fig. 1C). This is the highest elevational record in Costa Rica.

***Chondrohierax uncinatus* (Temminck, 1822), Hook-billed Kite.** This species occurs mainly near wetlands in lowlands and foothills below 1000 m on both coasts (Stiles and Skutch 1989, Garrigues and Dean 2014). From February 1997–June 2016, we observed 75 individuals (3.75 observations/year) of both juveniles and adults flying and feeding on snails near Jardín Botánico Lankester ($09^{\circ}51'00''$ N, $083^{\circ}53'00''$ W; 1350 m elev.) and at the Ujarras Valley area ($09^{\circ}49'38''$ N, $083^{\circ}49'00''$ W; 1000 m elev.) (Fig. 1D). On 15 April 2011, we found a dead female (MZUCR 4201) on the ground within a planted forest of the non-native *Cupressus lusitanica* Mill. in Concepción, Heredia province ($10^{\circ}02'02''$ N, $084^{\circ}03'38''$ W; 1500 m elev.). Another female was observed and photographed in Universidad Nacional main campus, Heredia province, on 21 March 2012 ($09^{\circ}59'56''$ N, $084^{\circ}06'38''$ W; 1154 m elev.). Individuals of this kite are recognized by a hooked beak, pale iris, and yellowish to orange lore. No other diurnal raptor has these characteristics in the country. These observations represent the first confirmed records in the Central Valley, and the female found at Concepción is the highest elevational record for the species in Costa Rica.

***Gampsonyx swainsonii* (Vigors, 1825), Pearl Kite.** This species breeds along the Pacific coast of Costa Rica, where it colonized from Panama in the mid-1990s, and sporadically has been recorded along the south Caribbean coast (Sandoval et al. 2010, Garrigues and Dean 2014). From 8 February–23 May 2016, we observed a pair flying and hunting at El Molino, Cartago province ($09^{\circ}51'32''$ N, $083^{\circ}55'38''$ W; 1415 m elev.) (Fig. 2A). On 18 April 2016, we recorded an individual calling at Jardín Botánico Lankester, Cartago province ($09^{\circ}51'00''$ N, $083^{\circ}53'00''$ W; 1350 m elev.), and the recording was deposited at the Laboratorio de Bioacústica, Universidad de Costa Rica (LBUCR002970). These individuals were recognized by the small size, buff front and cheeks, dark gray to plumbeous back, white belly, and reddish thighs. No other diurnal raptor has these characteristics. These

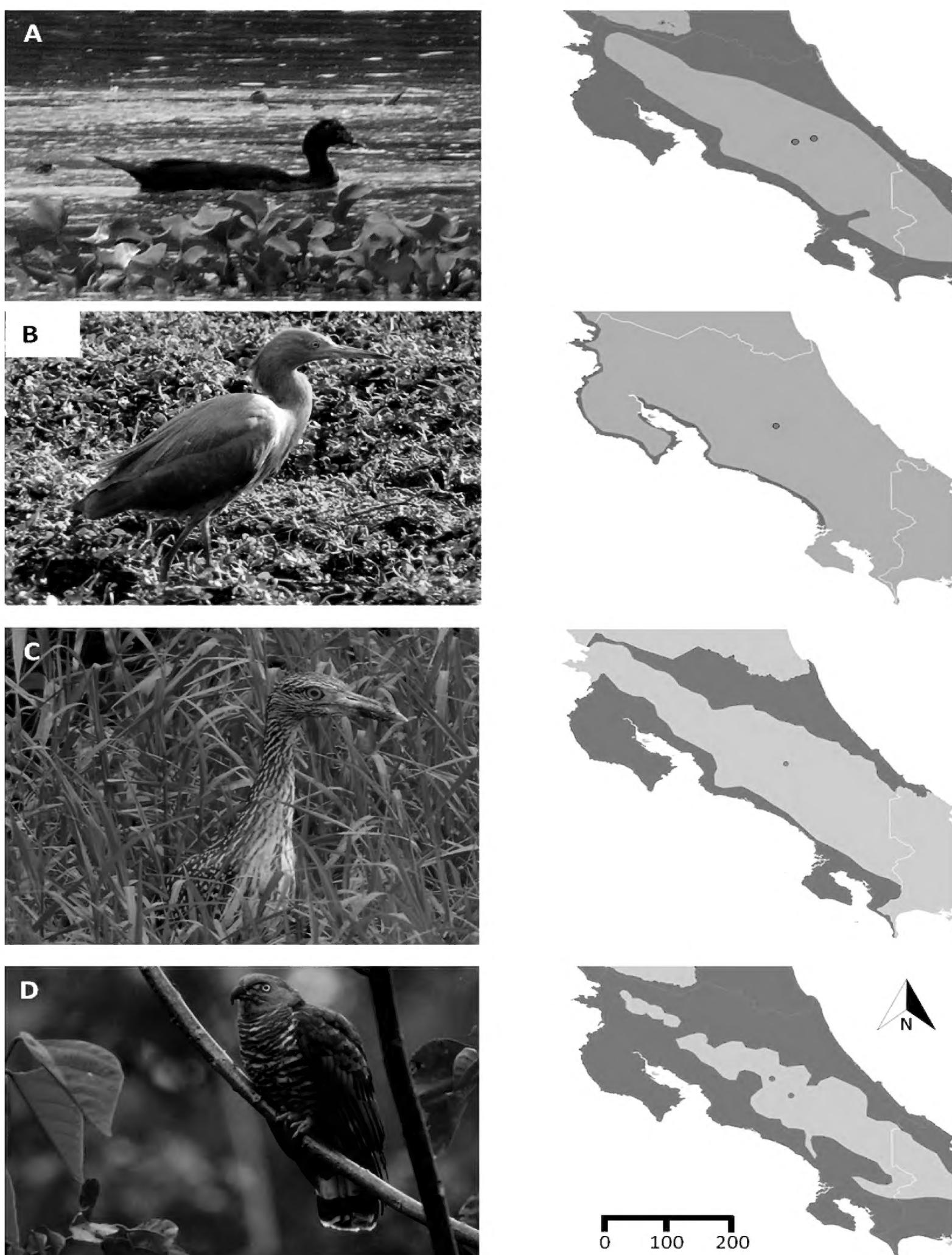


Figure 1. Photos of observed individuals at new localities (red dot), compared to current distribution in Costa Rica (bluish area on map of Costa Rica based on published information from Stiles and Skutch 1989 and Garrigues and Dean 2014). **A.** Muscovy Duck, *Cairina moschata* at Angostura reservoir, Cartago province (20 November 2014). **B.** Reddish Egret, *Egretta rufescens* at a temporal lagoon at Coronado, San José province (13 February 2011). **C.** Yellow-crowned Night-heron, *Nyctanassa violacea* at Las Concavas, Cartago province (18 October 2013). **D.** Hook-billed Kite, *Chondrohierax uncinatus* at Ujarras Valley, Cartago province (22 March 2012).

are the first records for the eastern Central Valley.

***Geotrygon montana* (Linnaeus, 1758), Ruddy Quail-dove.** This species occurs commonly below 1200 m along the Caribbean and south Pacific coast in Costa Rica (Stiles and Skutch 1989, Garrigues and Dean 2014). An injured female was found in a private yard at Barrio Dent, San Jose province ($09^{\circ}56'06''$ N, $84^{\circ}03'26''$ W; 1200 m elev.), on 16 March 2016 (Fig. 2B). It is distinguished from other quail-doves by its duller brown plumage, a red beak with black tip, and yellow iris (Fig. 2B). This is the first docu-

mented record of *G. montana* in the Central Valley.

***Panterpe insignis* Cabanis & Heine, 1860, Fiery-throated Hummingbird.** This species occurs commonly above 2000 m in Talamanca and the Central Volcanic mountain range in Costa Rica (Stiles and Skutch 1989, Garrigues and Dean 2014). A single individual was found foraging on *Stachytarpheta jamaicensis* (L.) Vahl flowers in a private garden in Tausito, Cartago province, on 6 June 2016 ($09^{\circ}47'11''$ N, $83^{\circ}45'07''$ W; 982 m elev.) (Fig. 2C). *Panterpe insignis* is recognized by a light-blue fore-

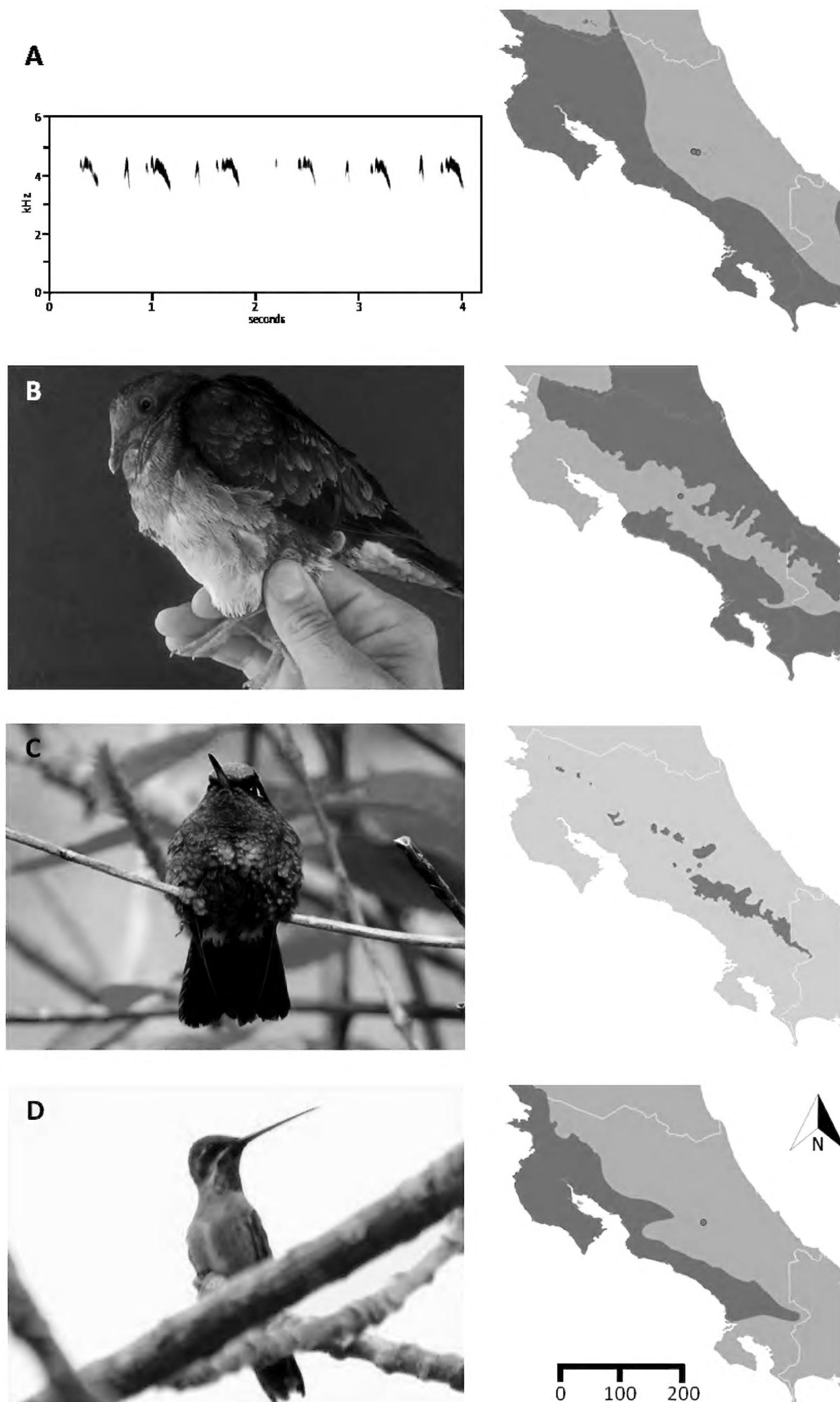


Figure 2. Photos of observed individuals at new localities (red dot), compared to current distribution in Costa Rica (bluish area on map of Costa Rica based on published information from Stiles and Skutch 1989 and Garrigues and Dean 2014). **A.** Pearl Kite, *Gampsonyx swainsonii* spectrogram of call recording at Jardín Botánico Lankester, Cartago province (18 April 2016). **B.** Ruddy Quail-Dove, *Geotrygon montana* after it collided into a window at Barrio Dent, San José province (16 March 2016). **C.** Fiery-throated Hummingbird, *Panterpe insignis* at Tausito, Cartago province (5 June 2016). **D.** Plain-capped Starthroat, *Heliomaster constantii* at Oreamuno, Cartago province (3 October 2014).

crown and breast and reddish throat, which distinguishes it from the similar *Eugenes spectabilis* (Lawrence, 1867), Talamanca Hummingbird and *Heliodoxa jacula* (Gould, 1850), Green-crowned Brilliant). This is the lowest Costan Rican record in the Talamanca mountain range.

***Heliomaster constantii* (DeLattre, 1843), Plain-capped Starthroat.** This species occurs below 1000 m in the dry forest and southern Pacific intermontane valleys of Costa Rica (Stiles and Skutch 1989, Garrigues and Dean 2014). On 3 October 2014, a single individual was seen perched on a leafless tree in Oreamuno, Cartago province ($09^{\circ}53'23''$ N, $083^{\circ}50'44''$ W; 1695 m elev.) (Fig. 2D). This hummingbird is distinguished from the similar *H. longirostris* (Audebert & Vieillot, 1801), Long-billed Starthroat, by the ruby throat and white malar line (Fig. 2D). This record represents the highest elevational record of this species in Costa Rica.

***Amazilia rutila* (DeLattre, 1843), Cinnamon Hummingbird.** This species occurs in the dry forest and western Central Valley below 900 m (Stiles and Skutch 1989, Garrigues and Dean 2014). A single individual was seen foraging on *Stachytarpheta jamaicensis* from 17–23 June 2016 at El Molino, Cartago province ($09^{\circ}51'32''$ N, $083^{\circ}55'38''$ W; 1415 m elev.) (Fig. 3A). This hummingbird is distinguished from the similar *Amazilia tzacatl* (La Llave, 1833), Rufous-tailed Hummingbird, by its rufous breast and belly (Fig. 3A). This sighting represents the highest elevational record in Costa Rica and the first in the eastern Central Valley.

***Eupsittula canicularis* (Linnaeus, 1758), Orange-fronted Parakeet.** This species occurs below 1000 m in the dry forest of Costa Rica (Stiles and Skutch 1989, Garrigues and Dean 2014). On 16 December 2015, we observed 4 individuals eating guava, *Psidium guajava* L. in a private yard (Fig. 3B) at El Molino, Cartago province ($09^{\circ}51'32''$ N, $083^{\circ}55'38''$ W; 1415 m elev.). This parakeet has an orange front and blue mid-crown (Fig. 3B), which distinguishes it from more common *Psittacara finschi* (Salvin, 1871), Crimson-fronted Parakeet, which has a red-fronted crown. This is the first record for the eastern Central Valley and the highest elevational record in Costa Rica.

***Pyrilia haematotis* (Sclater & Salvin, 1860), Brown-hooded Parrot.** This species occurs below 1500 m along Caribbean and southern Pacific coasts in Costa Rica (Stiles and Skutch 1989, Garrigues and Dean 2014). A group of approximately 30 individuals were observed from 15–22 August 2016 foraging in a fig tree (*Ficus* sp.) at Concepción, Heredia province ($10^{\circ}02'02''$ N, $084^{\circ}03'38''$ W; 1500 m elev.). We collected 1 individual on 19 August 2016 (MZUCR 5081). This parrot has a brown hood with reddish auricular patch (Fig. 3C), which distinguishes it from other Costa Rican parrots. This is the first published record of this species in the Central Valley in Costa Rica.

***Amazona albifrons* (Sparrman, 1788), White-fronted Parrot.** This species occurs in dry forest and western

Central Valley of Costa Rica, below 1200 m (Stiles and Skutch 1989, Biamonte et al. 2010, Garrigues and Dean 2014). We observed as many as 3 individuals at one time at Centro Agronómico Tropical de Investigación y Enseñanza, Cartago province ($09^{\circ}52'00''$ N, $083^{\circ}39'00''$ W; 615 m elev.), from 23 January 2013–4 March 2015 (Fig. 3D). At this site, we also observed 2 adults feeding recent fledglings on 26 December 2014. We also observed 2 individuals from 17 November 2015–28 January 2016 at El Molino, Cartago province ($09^{\circ}51'32''$ N, $083^{\circ}55'38''$ W; 1415 m elev.). This parrot has a white front and blue mid crown, red ocular patch, and yellow beak, which distinguishes it from *Pionus senilis* (Spix, 1824), White-crowned Parrot, which has a white crown and blue cheek. These observations are the first records in the eastern Central Valley and Turrialba Valley on the Caribbean slope of Costa Rica.

***Grallaria guatimalensis* Prévost & Des Murs, 1842, Scaled Antpitta.** In Costa Rica, this species occurs in montane forests between 800 and 1600 m on both slopes of the Guanacaste, Tilarán, Volcánica Central, and Talamanca ranges (Stiles and Skutch 1989, Garrigues and Dean 2014). One adult was observed on 11 May 2016 fighting against its reflection on a structure in a garden in the urban center of Barrio Dent, San José province ($09^{\circ}56'06''$ N, $084^{\circ}03'26''$ W; 1200 m elev.) (Fig. 4A). The individual was collected (MZUCR5202). This antpitta is recognized and distinguished from other antpittas in Costa Rica by its scaled back and rufous breast and belly. This is the first record of this species within the most urbanized area of the Central Valley.

***Empidonax albicularis* Sclater & Salvin, 1859, White-throated Flycatcher.** This species occurs in Costa Rica at elevations between 500 and 1500 m along the western and southern flanks of Irazú Volcano, on the Caribbean slope of the Guanacaste, Tilarán and Central Volcanic mountain ranges; and in the intermontane valleys of the southern Pacific lowlands (Stiles and Skutch 1989, Garrigues and Dean 2014). On 1 March 2015, we observed 1 individual perched on a clump of grass in a natural wetland at Medio Queso ($11^{\circ}01'48''$ N, $084^{\circ}41'15''$ W; 35 m elev.) (Fig. 4B). We also collected 1 individual on 20 January 2016 at Coto 47, Puntarenas province, in grasslands ($08^{\circ}29'23''$ N, $082^{\circ}58'40''$ W; 20 m elev.) (MZUCR 5111). This flycatcher is distinguished from other species of *Empidonax* by its white throat that contrasts with the brownish breast, yellow belly, and buff wing bars. These are the lowest records of this species in Costa Rica and the first from the northern Caribbean lowlands and the southern Pacific lowlands.

***Sayornis nigricans* (Swainson, 1827), Black Phoebe.** This species occurs in Costa Rica at elevations between 500 and 2000 m and usually close to bodies of water such as creeks, rivers, and lagoons (Stiles and Skutch 1989, Garrigues and Dean 2014). On 3 October 2008, we observed 2 individuals and photographed a nest (Fig. 4C) under

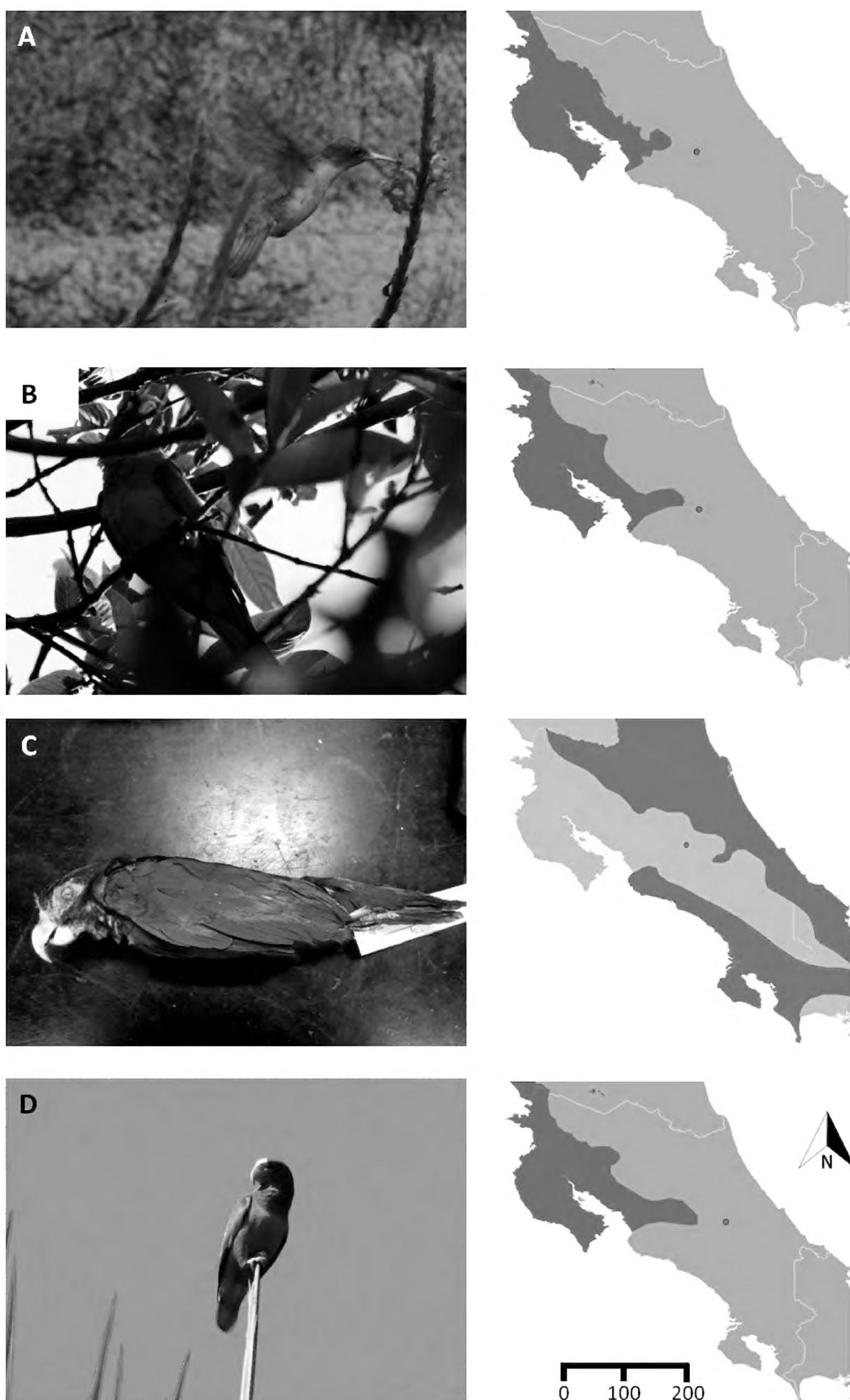


Figure 3. Photos of observed individuals at new localities (red dot), compared to current distribution in Costa Rica (bluish area on map of Costa Rica based on published information from Stiles and Skutch 1989 and Garrigues and Dean 2014). **A.** Cinnamon Hummingbird, *Amazilia rutila* at El Molino, Cartago province (17 June 2016) **B.** Orange-fronted Parakeet, *Eupsittula canicularis* at El Molino, Cartago province (16 December 2015). **C.** Brown-hooded Parrot, *Pyrilia haematotis* collected at Concepción, Heredia province (19 August 2016). **D.** White-fronted Parrot, *Amazona albifrons* at Centro Agronómico Tropical de Investigación y Enseñanza Turrialba, Cartago province (23 January 2013).

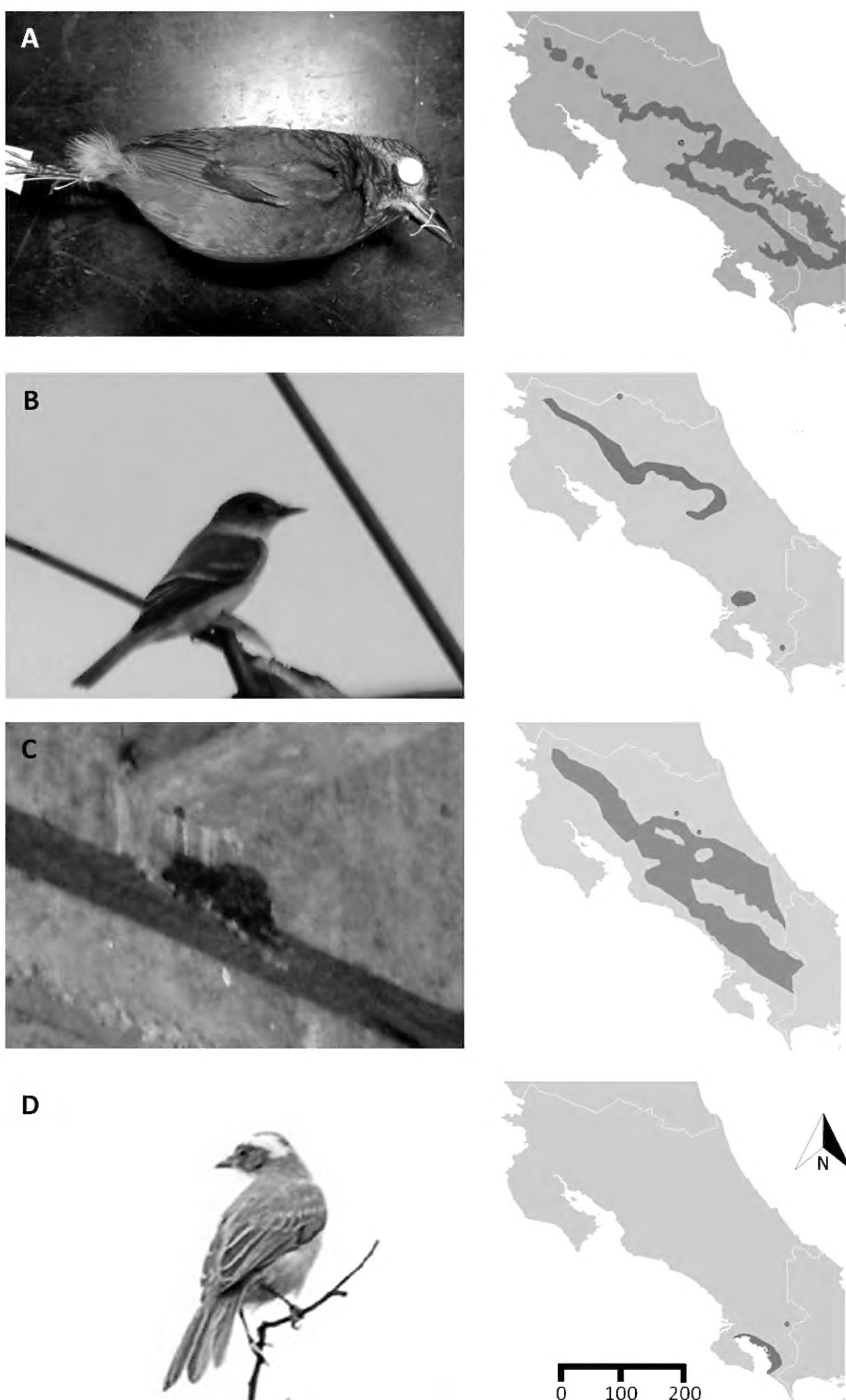


Figure 4. Photos of observed individuals at new localities (red dot), compared to current distribution in Costa Rica (bluish area on map of Costa Rica based on published information from Stiles and Skutch 1989 and Garrigues and Dean 2014). **A.** Scaled Antpitta, *Grallaria guatimalensis* collected at Montes de Oca, San José province (11 May 2016). **B.** White-throated Flycatcher, *Empidonax albicularis* at Medio Queso wetlands, Alajuela province (1 March 2015). **C.** Black Phoebe, *Sayornis nigricans* nest under Rio Corinto Bridge, Limón province (3 October 2008). **D.** Rusty-margined Flycatcher, *Myiozetetes cayanensis* at Las Juntas de Coto Brus, Puntarenas province (11 June 2016).

the bridge of Río Corinto, Limón province ($10^{\circ}12'42''$ N, $083^{\circ}53'09''$ W; 226 m elev.). Additionally, we observed on 21 March 2015 a single individual foraging at Río Sarapiquí, Reserva Tirimbina, Heredia province ($10^{\circ}23'45''$ N, $084^{\circ}08'03''$ W; 193 m elev.). This species is recognized by its black body plumage contrasting with its white belly. These are the lowest records of this species in Costa Rica and the lowest record of breeding.

***Myiozetetes cayanensis* (Linnaeus, 1766), Rusty-margined Flycatcher.** In Costa Rica this species occurs along the Golfo Dulce border, below 200 m, where it arrived from Panama in 2004 (Sandoval et al. 2010, Garrigues and Dean 2014). We observed on 11 June 2016 a single individual perched on an exposed perch at the edge of a coffee plantation at Las Juntas de Coto Brus, Puntarenas province ($08^{\circ}51'01''$ N, $082^{\circ}56'25''$ W; 880 m elev.) (Fig. 4D). This flycatcher is distinguished from *M. similis* (Spix, 1825), Social Flycatcher, by the rusty edges on the primary feathers of the wings and blackish cheeks. This is the first record outside of the Golfo Dulce region and the highest record in the country.

***Dacnis venusta* (Lawrence, 1862), Scarlet-thighed Dacnis.** This species occurs along the middle elevations of the Caribbean slope, between 400 and 1500 m along the Pacific slope of the Talamanca mountain range, and in mountains of the Osa Peninsula (Stiles and Skutch 1989, Garrigues and Dean 2014). We collected a juvenile male (MZUCR 4832) on 19 January 2015 at Golfito, Puntarenas province ($08^{\circ}38'31''$ N, $083^{\circ}11'37''$ W; 22 m elev.) (Fig. 5A). This juvenile male dacnis is distinguished from *D. cayana* (Linnaeus, 1766), Blue Dacnis, by its buff breast and belly and by its black beak. This is the lowest record of *D. venusta* in Costa Rica.

***Saltator grossus* Linnaeus, 1766, Slate-coloured Grosbeak.** This species only occurs on the Caribbean slope of Costa Rica, at elevations up to 1200 m (Stiles and Skutch 1989, Garrigues and Dean 2014). On 21 April 2016, we photographed an individual, which was foraging on fruits, at the edge of Quebrada Bonita, Carara National Park, Puntarenas province ($09^{\circ}46'30''$ N, $084^{\circ}36'18''$ W; 42 m elev.) (Fig. 5B). This grosbeak has a plumbeous plumage, with a distinctive white throat and red beak. This is the first record of *S. grossus* on the Pacific side of Costa Rica.

***Lonchura malacca* (Linnaeus, 1766), Tricolored Munia.** This species was observed in Costa Rica for the first time in May 1999 at La Guineña, Guanacaste province (Sandoval et al. 2010). From the first observation, *L. malacca* has expanded its range along the Pacific coast as far south as Palmar Sur, Puntarenas province (Sandoval et al. 2010). A group of 20–30 individuals was observed on 8 February 2015 at Barrio San José, Alajuela province ($10^{\circ}01'09''$ N, $084^{\circ}14'56''$ W; 897 m elev.), where they were foraging in grasslands (Fig. 5C). One individual, a juvenile, was collected (MZUCR4991). This juvenile is distinguished from female seedeaters (e.g. *Sporophila* spp.), by its thick, black beak, rufous back and wings, which contrast with

its clear, brown breast and belly. This is the first published record of *L. malacca* from the Central Valley and the highest record in the country.

Discussion

The occurrence of some species outside of their regular Costa Rican distribution may be explained by similar habitat requirements. For example, the 4 species that are routinely found around wetlands—*C. moschata*, *E. rufescens*, *N. violacea*, and *C. uncinatus*—were all found in artificial wetlands in the country's interior. The elimination and reduction of natural wetlands near the coast are forcing these species to use other, often artificial water bodies, such as water reservoirs and small ornamental lakes, that are inland and at higher elevations, (Sánchez et al. 2014, Sandoval et al. 2016). Although this pattern has increased recently (Sandoval et al. 2010, 2016, Sandoval 2013), we still are unsure if birds are using these resources because they are suitable for their needs or simply because it is the only available habitat. More research is required to evaluate the long-term efficacy of these habitats to sustain viable bird populations.

Dry-forest obligate species (*E. canicularis*, *A. abifrons*, *H. constantii*, and *A. rutila*) and species that require open areas (*G. swainsonii*, *M. cayanensis*, and *L. malacca*) may be expanding due to more available habitat caused by increased urbanization and deforestation (Sandoval 2009, Biamonte et al. 2011). Additionally, widespread fragmentation of mesic forest eliminates potential dispersal barriers between once-isolated dry forests, which may facilitate the observed expansion of dry-forest and open-area species (Sandoval et al. 2010, Biamonte et al. 2011). Another cause for the movements of these species may be related to increased temperature, which allows for colonization at higher elevations (Colwell et al. 2008, Sekercioglu et al. 2008). Four species show movements to lower elevations (*P. insignis*, *S. nigriceps*, *E. albogularis*, and *Dacnis venusta*). These species probably are undergoing elevational movements as has been reported for altitudinal migrants in the Neotropics that descend to lowland forest during the dry season (Loiselle and Blake 1991, Boyle 2010). However, the presence of these species in lowlands may be due to poor weather conditions in the highlands, which may cause individuals to move to the lowlands in search of food or to avoid the adverse weather (Avalos 2005, Boyle 2010, 2011).

Three species (*G. montana*, *P. haematotis*, and *G. guatimalensis*) show an unclear pattern of movement. *Geotrygon montana* and *Grallaria guatimalensis* are understory birds that have arrived to the downtown center of San José, the most urbanized area in Costa Rica. Probably *G. montana* has a natural propensity for vagrant movements, which allows it to colonize new places, but this leads some individuals to reach unusual places. The arrival of *G. guatimalensis* to a garden in the middle of the city is a mystery. We hypothesize that this species are using river vegetation to move between populations, and

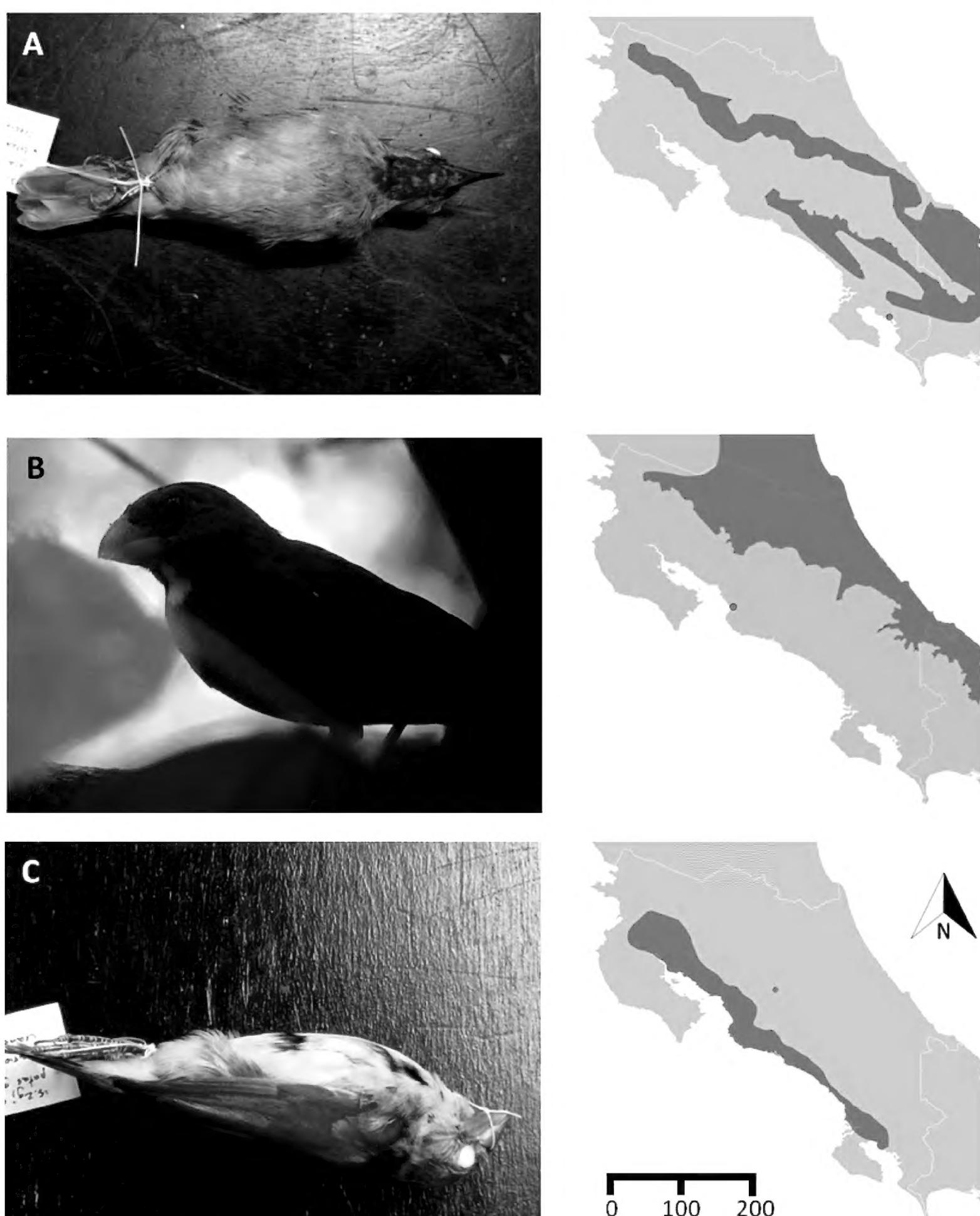


Figure 5. Photos of observed individuals at new localities (red dot), compared to current distribution in Costa Rica (bluish area on map of Costa Rica based on published information from Stiles and Skutch 1989 and Garrigues and Dean 2014). **A.** Scarlet-thighed Dacnis, *Dacnis venusta* collected at Golfito, Puntarenas province (19 January 2015). **B.** Slate-colored Grosbeak, *Saltator grossus* at Carara National Park, Puntarenas province (21 April 2016). **C.** Tricolored Munia, *Lonchura malacca* collected at Barrio San José, Alajuela province (8 February 2015).

in this case, is possible to find at least 2 populations in a 10 km radius from our new record. Therefore, the individual that we found was probably moving between populations but became disoriented. *Pyrilia haematonotis*, which are known to have altitudinal movements (Stiles and Skutch 1989), probably arrived in the Central Valley by these means.

Finally, *S. grossus* shows movements comparable to other Caribbean species, such as *Icterus prosthemelas* (Strickland, 1850) (Black-cowled Oriole), *Molothrus bonariensis* (Gmelin, 1789) (Shiny Cowbird), and *Tigrisoma fasciatum* (Such, 1825) (Fasciated Tiger-Heron), which have colonized the Pacific rainforest (Alvarado-Quesada and Biamonte 2003, Sandoval et al. 2010, Sando-

val and Fernández-Ramírez 2012). Until now, no reasons have been proposed for the movements of these species from the Caribbean to Pacific rainforests. These species are not recorded in habitats between the Caribbean and Pacific rainforests and appear to represent single movements of isolated individuals between habitats. Nevertheless, the similarity in habitat structure and weather conditions between Caribbean and Pacific rainforests may help the establishment of Caribbean species after colonization.

Acknowledgements

We thank Randall Arguedas and Manuel Bozzoli for sharing their observations of *Geotrygon montana* and

Chondrohierax uncinatus, respectively. We thank to Michael J. Andersen and an anonymous reviewer for valuable comments the manuscript.

Authors' Contributions

LS, DM, DO, MVP, DAH, EC, AGR, and MS made the observations and photographs, and all equally shared in writing the manuscript.

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